AD-A143 692 SECTION 32 PROGRAM STREAMBANK EROSION CONTROL EVALUATION AND DEMONSTRATIO..(U) ARMY ENGINEER WATERWAYS EXPERIMENT STATION VICKSBURG MS M P KEOWN 1/1

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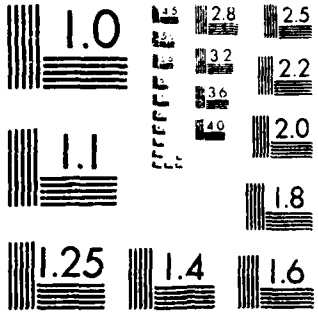

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SECTION 32 PROGRAM
STREAMBANK EROSION CONTROL EVALUATION AND DEMONSTRATION
WORK UNIT 2 - EVALUATION OF EXISTING BANK PROTECTION

INSPECTION OF SITES IN ALBUQUERQUE DISTRICT

by

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SECTION 32 PROGRAM

STREAMBANK EROSION CONTROL EVALUATION AND DEMONSTRATION

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INSPECTION OF SITES IN ALBUQUERQUE DISTRICT

1. The Southwestern Division (SWD), CE, has currently proposed monitoring of four existing sites in the Section 32 Program. One proposed site, the gabion protection works on Cuchillo Negro Creek near Truth or Consequences, New Mexico, was nominated in the Albuquerque District (SWA). In addition, SWA has proposed that the Kellner Jack Field on the Rio Grande River near Espanola, New Mexico, also be included in the Section 32 Program. These sites were inspected on 21 and 23 June 1977, respectively. Prior to making the inspections, Mr. M. P. Keown of the WES Mobility and Environmental Systems Laboratory met with Messrs. F. B. Collins and J. Ramsey, Jr., both of SWA. Mr. Collins provided the project notebook for each site. The notebooks were examined and materials were selected for copying that should be added to the WES files.

2. Each site inspection consisted of:

   a. Preparing a site map of the reach that included the streambank protection works.

   b. Taking pertinent photographs.

   c. Taking a bag sample of disturbed soil subject to erosive action near the protection works.

   d. Identifying and taking notes on the factors affecting the integrity of the protection works.

Detailed narratives relevant to each of the sites are provided below. The information included in the narratives was derived from the WES on-site inspection and additional material provided by SWA.

Cuchillo Negro Creek near Truth or Consequences, New Mexico

3. Cuchillo Negro Creek, a west bank tributary, enters the Rio Grande just upstream from Truth or Consequences (Figure 1). The creek, which originates along the Continental Divide in the western part of Sierra County, is 60 miles long and drains an area of 325 square miles. A low 25-acre area along the south bank of the creek is protected by an existing levee extending from high ground to the New Mexico Highway 51 Bridge. A lower levee is located along the north bank. Both of these

levees are constructed of native materials (sandy gravel) and are highly erosive even during low flows. Failure of the south bank levee would result in flash flooding to the low area which contains three permanent residences, 50 to 60 mobile homes, a ready-mix concrete plant, a boat storage facility, and a marine service (Figure 2).

4. This reach is characterized by steep bed gradients (40 ft/mile) and high peak discharges that occur during periods of intense rainfall. The upper reach of the stream above the community of Cuchillo is perennial; however, downstream from there the stream becomes ephemeral due to agricultural irrigation. Major flows occur during the rainy season from July to September each year. The riverbed in the vicinity of the bank protection work is dry during most of the remaining months. No regular stage recording stations are located on the creek; however, during the August 1975 flood, the USGS recorded a peak discharge of 21,400 cfs. Sparse vegetation has become established on the levee faces (Figure 3).

5. The construction date is not known for either levee nor is the builder. Mr. Harmilo Sedillo, the Sierra County Road Superintendent, said the levees were pre-1955; however, no other information is available. The Corps became involved in the project after a flood disaster in 1972. Funds were made available under the continuing authority of Public Law 84-99 (28 June 1955) to preserve and repair existing flood protection works. The $86K project was awarded to Vesper Materials Co., Espanola, New Mexico, on 14 November 1972. Work commenced on 4 December 1972 and was completed within the specified construction period on 26 January 1973. This effort consisted of extensive levee repairs on both banks along approximately 3,400 ft of Cuchillo Creek and the installation of seven pairs of rock-filled gabion-type training dikes to control the channel approach to the Highway 51 Bridge (Figure 4).

6. An inspection conducted by Mr. Collins on 11 April 1974 indicated that the seven pairs of gabion dikes and the north levee were in an as-built condition. The south levee was intact except for a minor toe cut about 2 ft high by 50 ft long due to low flows in 1973.

7. In 1974, the Corps of Engineers agreed to restore the damaged levee embankment and furnish additional gabions to Sierra County. The county agreed to furnish the labor required, equipment, and rock fill for the gabions. The plan was to place several courses of gabions parallel to the bank at locations subject to severe erosion. The county proceeded with the gabion installation in August 1975. On 5 September 1975 when the first course of gabions had been partially installed, high creek flows caused a suspension of the work. These flows resulted in damage to the uncompleted gabion revetment and to the levee embankment. An additional inspection conducted by Mr. Collins on 10 October 1975 indicated that the upstream half of this project had been severely damaged. About 600 ft of the north levee was eroded by streamflows in 1974 and September 1975; 200 ft were nearly gone. The right-of-way fence was undercut and still hangs in the gap (Figure 5). The present bank at this location is about 3 ft high. Floodwater here was within 2 in. of

overtopping this cut bank. The south levee was deeply cut but not breached. The flows that passed over the incompleted revetment cut the levee halfway through. The lower half of this project was in good condition. The seven pairs of gabion training dikes completely controlled the floods and protected the levees on both sides.

8. Cuchillo Creek flowed only 2 to 3 ft deep at flood crest, yet it cut and removed hundreds of feet of levee 12 to 15 ft high by 25 ft wide at crest. The finely engineered and carefully groomed 1-on-3 slopes melted away like so much sugar when a couple of feet of water encountered the toe. Toe and slope protection are vital in sandy projects, as the lower half of this project attests.

9. Before repairs of the 1975 flood damage, another 15,000-25,000 cu yd of levee erosion occurred in the September 1976 flood. In October 1976 and April 1977 the south levee was repaired. The now completed work includes: (a) placement of compacted fill secured from the channel bed in the eroded areas of the levee (Figure 6), (b) placement of rockfill protection in selected portions of the restored levee, (c) completion of the gabion revetment installation on the west end of the levee (Figure 7), and (d) installation of eight training dikes between the existing training dikes and the gabion revetment installation. A project map for this work is shown in Figure 8. Federal and local participation costs were $38,000 and $22,000, respectively. Land use reevaluation of the area behind the north levee indicated that there was nothing of value to protect; therefore no efforts were made to protect this levee, thus allowing the creek width to expand and reduce flow concentrations along the south levee.

10. The proposed monitoring program for this site would consist of soil sampling, cross-section surveys, stage and velocity measurements, and photographic coverage of both the bank conditions and flow patterns developed along the levee. Records indicate that a very limited amount of discharge data have been developed for Cuchillo Negro Creek (none published); no known water-quality samples have been taken.

Rio Grande River near Espanola, New Mexico, (Mile 1622.6)

(Proposed by Albuquerque District--Not Yet Submitted or Approved by SWD or the Steering Committee)

11. The purpose of this project was to provide protection for the Santa Clara irrigation canal (Figure 9) which parallels the west bank of the Rio Grande on the Santa Clara Pueblo near Espanola, New Mexico (Figure 10). The bed gradient through this reach is 9 ft/mile. Prior to construction of the project, the river had eroded the west bank until the canal was in danger of being undermined and destroyed.

F. D. Shufflebarger, Inc. (Albuquerque) installed 4,313 lineal feet of permeable jetties (Kellner Jack Field) in 1951 (Figures 11 and 12). This installation consists of two main-line jetties (2,900 and 700 ft in length) and six backup retards varying from 133 to 265 ft in length. The jack units consist of three linear members (each being 15 ft in length) bolted together at their midpoints such that each member is perpendicular to the other two. The members are laced with #10 steel wire; the jack units are connected with cable (Figure 13). The Bureau of Indian Affairs sponsored this project at a funding level of $24,108 (1951 dollars).

12. Inspections performed by SWA in 1955, 1956, 1958, 1960, 1963, and 1968 indicated that the project was performing its function; some of the jacks were in poor condition at the time of the 1968 inspection. Considerable sediment deposition had occurred, providing a substrate for dense growths of willow, Russian olive, and underbrush that have measurably improved the stability of the bank (Figure 14).

13. Six new jacks were required in 1969 as a repair measure. Beginning in 1972, a gravel bar began to build up in front of the project which has served to direct the flow away from the Kellner Jack Field (Figures 15 and 16). The last inspection, conducted in November 1976, indicated that the project has been effective in preventing further bank erosion and has encouraged sediment deposition and general restoration of the eroded bank. A project file including the inspection reports is available at the SWA office.

14. A stream gaging station has been maintained by the USGS at mile 1,614.2 since 1895. The station is physically located on the right bank pier of an abandoned railroad bridge, some 400 ft downstream from the New Mexico State Highway 4 Bridge. The official name of the station is Otowi Bridge, near San Ildefonso, New Mexico (Figure 17). The maximum discharge of record through this reach is 24,400 cfs (23 May 1920) and the minimum, 60 cfs (5 July 1902). Historical data indicate that greater flows probably occurred in 1741 and 1884. The average discharge through this reach for the period of record is 1,506 cfs.

15. A water-quality station has been maintained at this site by the USGS since 1946. Extremes for the period of record are:

Water Temperature -	Maximum:	31°C, 5 August 1954
	Minimum:	Freezing on many days
Sediment Concentrations -	Maximum:	43,500 mg/ℓ, 21 August 1955
	Minimum:	11 mg/ℓ, 27 July 1963
Sediment Loads -	Maximum:	366,000 tons/day, 23 August 1961
	Minimum:	3 tons/day, 27 July 1963

16. Data for this station are published in the annual "Water Resources Data for New Mexico."

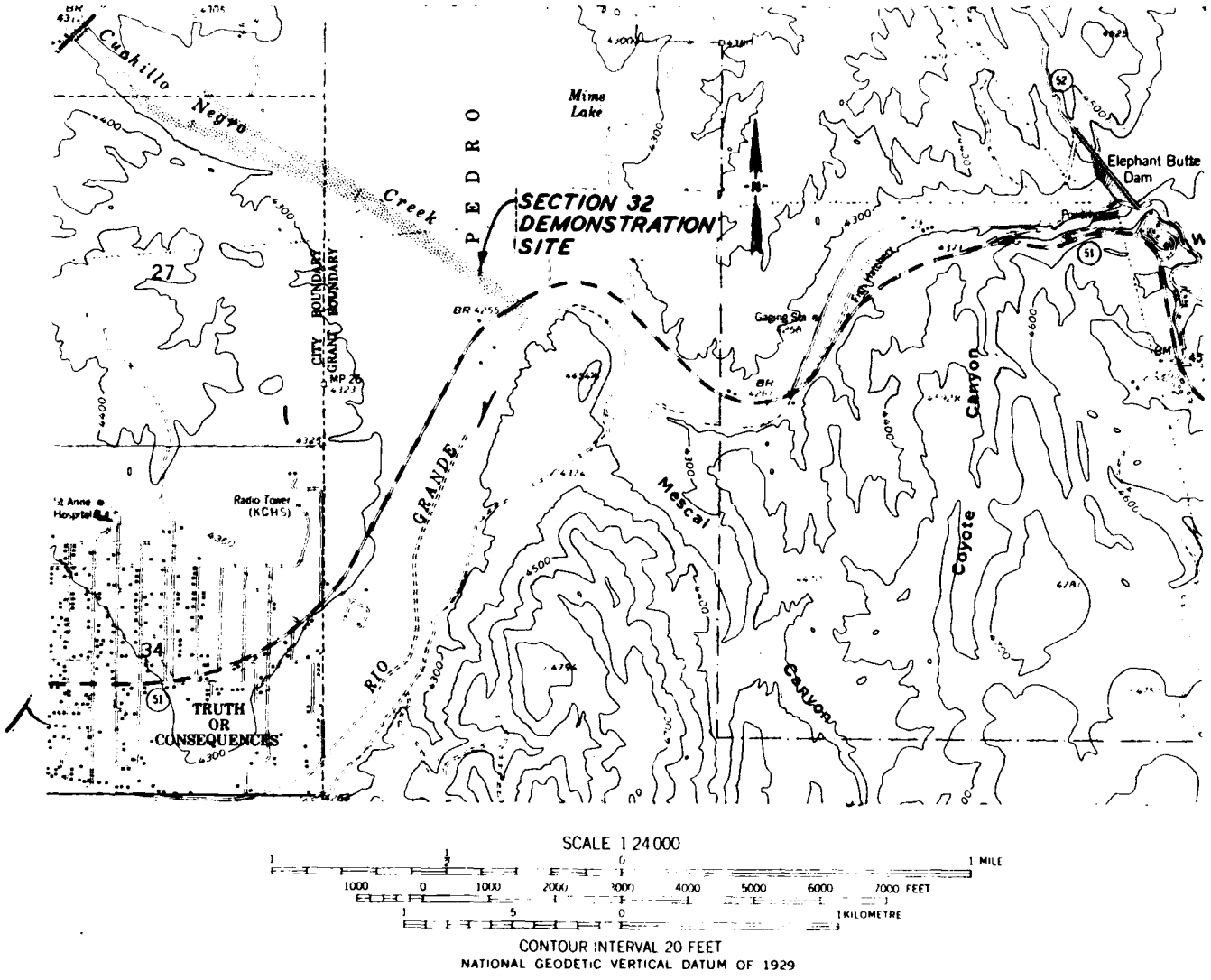

Figure 1. Cuchillo Negro Creek near Truth or Consequences, New Mexico.
Source: USGS quadrangle map for Elephant Butte, New Mexico (1959)

Figure 2. Mobile home community behind south levee; access road to levee is in the right-hand portion of the photograph

Figure 3. View from north levee looking west. Sparse vegetation has become established on levee face

Figure 4. Gabion training dike placed by Vesper Materials Co. in December 1972

Figure 5. Right-of-way fence undercut on north levee

Figure 6. Fill material for eroded levee areas was secured from the channel bed

Figure 7. Completed gabion revetment on west end of south levee

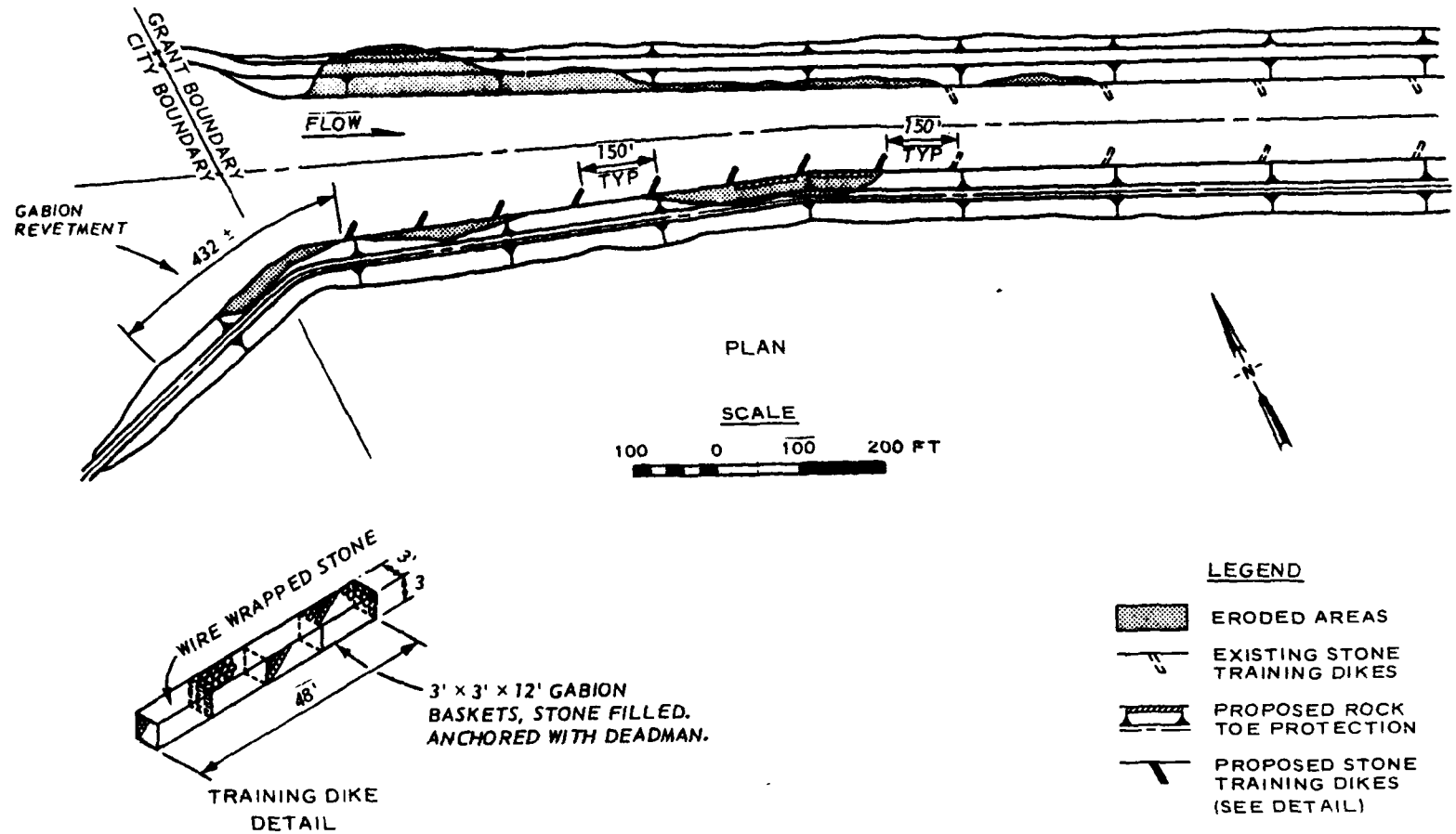

Figure 8. Project map for work completed in 1977

Figure 9. Irrigation canal on the Santa Clara Pueblo

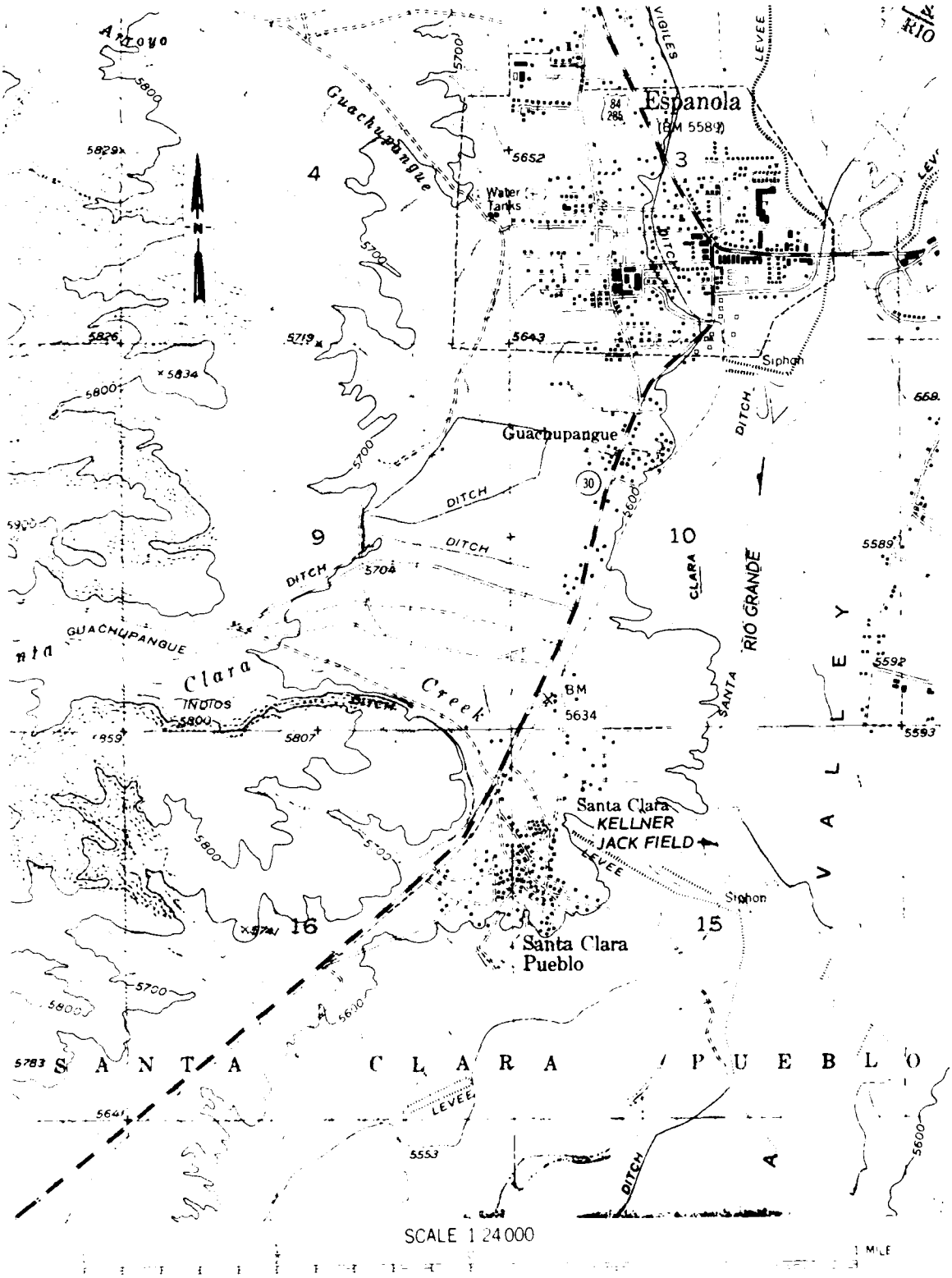

Figure 10. Rio Grande River near Espanola, New Mexico. Source: USGS quadrangle map for Espanola, New Mexico (1953)

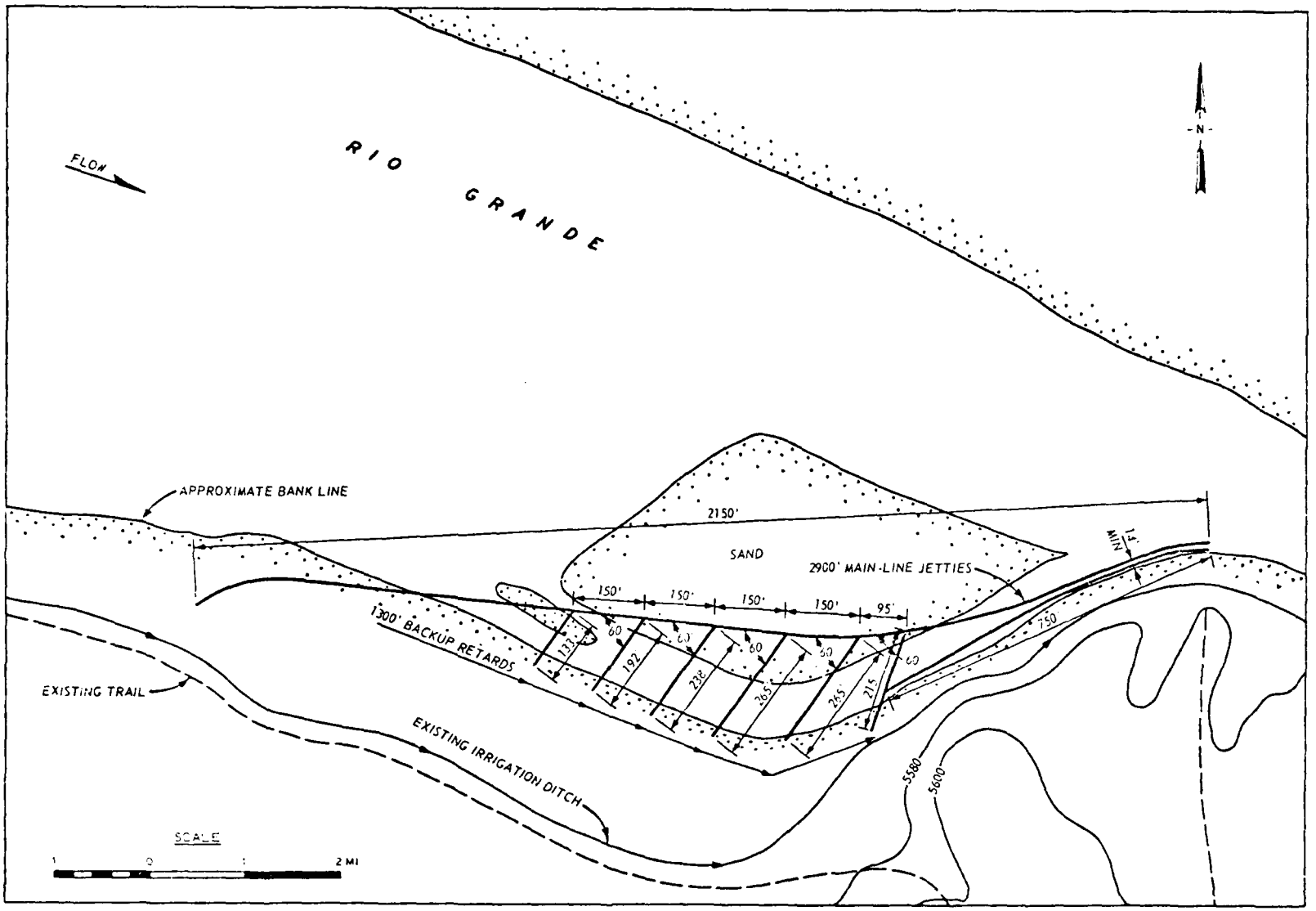

Figure 11. Project map for the Kellner Jack Field installed in 1951

Figure 12. Section of main-line jetty

Figure 13. Jacks units are connected with steel cable; this figure shows the cable configuration at the junction of a main-line jetty and retard line

Figure 14. Dense vegetation growths have improved the stability of the bank

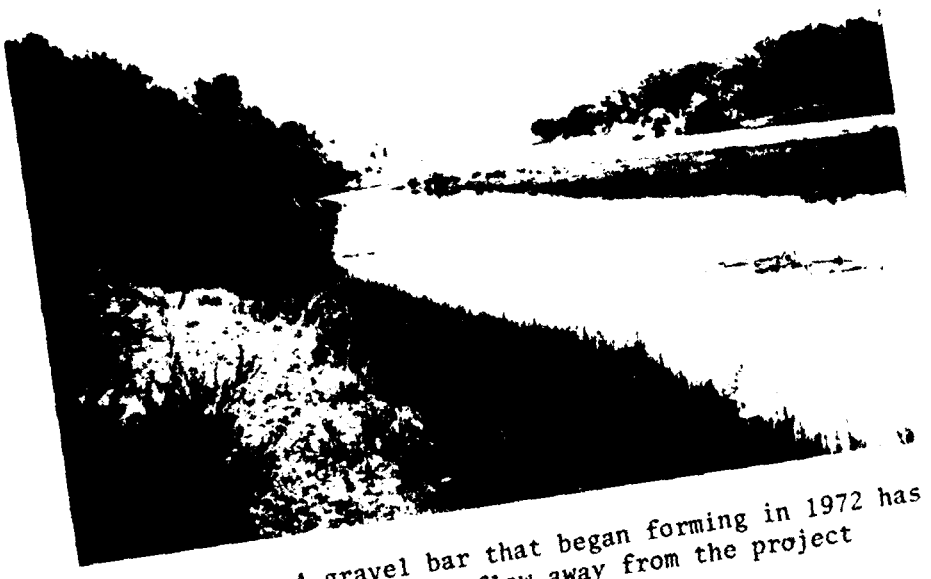

Figure 15. A gravel bar that began forming in 1972 has directed the streamflow away from the project

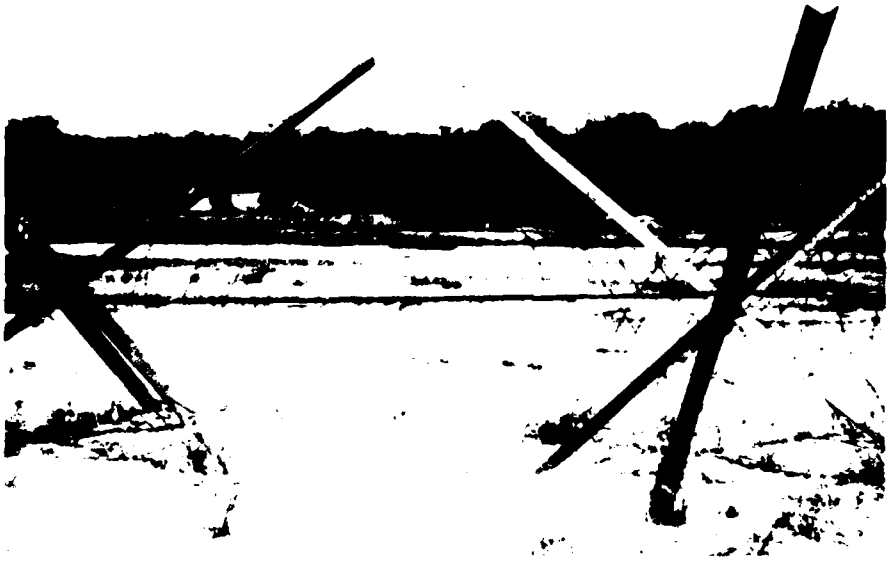

Figure 16. During low flows, the major portion of the discharge passes between the gravel bar and the left bank

Figure 17. Equipment for the gaging and water-quality station at Otowi Bridge, near San Ildefonso, New Mexico, is located in the small metal building in the center of the picture. The Rio Grande is just beyond the building, although not shown in the figure

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